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秦岭六种提灯藓的染色体研究*

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CHROMOSOME NUMBERS OF SIX SPECIES OF *MNIUM* FROM QINLING RANGE IN CHINA

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Abstract Reported in this paper are chromosome numbers of six species of *Mnium* from Qinling Range . The chromosome number of *M. pseudolycopodioides*, n＝6, is reported here for the first time. The counts for *M. marginatum* and *M. lycopoidioides*, n＝12 and n＝6 respectively, agree with the previous reports , and those for *M. laevinerve*, *M. heterophyllum* and *M. thomsonii*, here all found to be n＝6, differs from some or all previously published chromosome numbers for these three species.

Key words *Mnium*; Mitosis; Meiosis; Chromosome numbers

摘要 本文以藓类植物的幼嫩孢蒴及茎尖为材料，对产于中国秦岭的六种提灯藓的染色体进行了观察计数。首次报道了 *M. pseudolycopodioides* 的染色体数目为 n＝6；*M. marginatum* 和 *M. lycopoidioides* 的染色体数分别为 n＝12 及 n＝6，与前人报道的结果一致；*M. Laevinerve*、*M. heterophyllum* 以及 *M. thomsonii* 的染色体数目均为 n＝6，与前人的报道不完全相同。本文旨在为本属的研究提供一定的细胞学资料。

关键词 提灯藓属；有丝分裂；减数分裂；染色体数目

Mnium is a large genus in the family Mniaceae, consisting of about 100 species in the world. This genus has a global distribution but is most richly represented in the warm temperate regions of the Northern Hemisphere. In China, 49 species have been recorded, 29 of which are native to Qinling Range (Northwest Institute of Botany, 1978; Li *et al*, 1979).

Mnium is the first moss genus to which cytological data were applied to solve its systematic problems (Lowry, 1948). Since then, numerous cytological and cytotaxonomical studies have been made on this genus (Bowers, 1980, 1968 ;Bryan, 1973; Ono, 1970, 1967a, 1967b, 1967c; Tatuno *et al.*, 1966;Holmen, 1958). Lowry (1948) and Bowers (1980,1968) pointed out that cytological data can provide quite important information for the clarification of the intergeneric relationships of the family Mniaceae and the interspecific relationships within the genus *Mnium*.

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In this paper, chromosome numbers of six species in *Mnium* from Qinling Range are reported, with a view to offering some cytological evidence for a better understanding of the interspecific relationships of *Mnium* in this area.

1 Materials and Methods

All the plants studied here were collected from Qinling Range (Table 1). The voucher specimens are deposited in the Herbarium of Department of Biology, Shaanxi Normal University (SANU).

Table 1 The origin of the experimental materials

Species	Habitat	Voucher
M. pseudolycopodioides C. Muell.	Sunny slope, 1300 m	Y. P. Xiao, W. G. Fu, 924002
M. marginatum (With) P. Beauv.	Shadowy slope, 1400 m	Y. P. Xiao, Y. R. Liu, 923008
M. lycopodioides Schwaegr.	Shadowy slope, 1400 m	Y. P. Xiao, 923009
M. laevinerve Card.	Sunny slope, 1900 m	Y. P. Xiao, 924032
M. heterophyllum (Hook.)Schwaegr.	Sunny slope, 1300 m	Y. P. Xiao, Y. R. Liu, 924001
M. thomsonii Schimp.	Shadowy slope, 1500 m	Y. P. Xiao, Y. R. Liu, 923038

The technique for chromosome preparation follows Zhou *et al.* (1988). In the field, immature capsules and stem apices were fixed in Carnoy's fluid (absolute alcohol: glacial acetic acid = 3:1) for 4～12 hours, and then transferred to 70% alcohol and kept in it at low temperature. When making preparations of sporocyte meiosis, calyptra and operculum were removed in Carnoy's fluid with scalpel under stereomicroscope, and the sporocyte layer was then stripped carefully from the surface of columella, and stained in carbol fuchsin. When making preparations of stem apex mitosis, the stem apices were not treated and were directly placed on slides , on which a drop of carbol fuchsin fluid was added for staining. For permanent preparation, the slides and coverslips were separated rapidly after being frozen with liquid nitrogen and the slides were washed with absolute ethanol for 2～3 min. The preparations were finally remounted in gum arabic. The chromosomes were observed and photomicrographed under an Olympus BH2 microscope.

2 Results

2.1 *M. pseudolycopodioides* C. Muell.

Six bivalents were observed at metaphase I of sporocyte meiosis (Plate 1:1). Thus, the chromosome number of this species is n=6, which is reported here for the first time.

2.2 *M. marginatum* (With.) P. Beauv.

Twelve chromosomes were observed at mitotic metaphase of stem apices of the gametophytes (Plate 1: 2). This species has been cytologically studied previously by Lowry (1948), Holmen (1958), Bowers (1980,1968), Smith *et al.* (1968), Bryan (1973), Kumar *et al.* (1983) . All obtained the same result.

2.3 *M. lycopodioides* Schwaegr.

From our observations on the metaphase I and anaphase I of sporocyte meiosis (Plate 1: 3,4), the chromosome number of this species was counted as n=6. The result agrees with the previous reports by Ono *et al.* (1977) and Kumar *et al.* (1987). The plants studied by Bowers (1980) under the name *M. lycopodioides*, which have also the number of n=6, however, should be actually identified as *M. ambiguum* (Koponen, 1981).

2.4 *M. laevinerve* Card.

Our observations on the metaphase I and anaphase I of sporocyte meiosis (Plate 1: 5,6) showed that this species had the chromosome number of n=6. The result agrees with the previous report by Kumar (1973), but disagrees with the reports of n=7 by Tatuno *et al.* (1966) and by Ono (1970) for this species.

2.5 *M. heterophyllum* (Hook.) Schwaegr.

Our observations on the metaphase I and anaphase I of sporocyte meiosis (Plate 1: 7,8) showed that this species had the chromosome number of n=6. Ono (1970; 1967c, under the name *M. sapporense*) twice reported the chromosome number of this species as n=7, while Kumar *et al.* (1983) reported it as n=12, but Kumar *et al.* (1987) reported it as n=6.

2.6 *M. thomsonii* Schimp.

Our observation on the metaphase I and anaphase I of sporocyte meiosis (Plate 1: 9, 10) showed that this species had the chromosome number of n=6. The result agrees with the previous report by Bowers (1968) but disagrees with the report of n=8 by Ono (1970) for this species. Kuta *et al.* (1984) reported two chromosome numbers of n=6 and 12 for this species from Poland.

3 Discussions

Lowry (1948) proposed the basic chromosome number of the genus *Mnium* as n=6, but Tatuno *et al.* (1966) established it as n=7. All the six species studied here have the basic number of n=6.

The genus *Mnium* can be conveniently divided into three groups based on the marginal teeth of the leaves, i. e. single-toothed group, double-toothed group and entire-leaved group. This grouping, as Bowers (1968) pointed out, is not so artificial as it would seem at first glance since it is supported by cytological evidence. Bowers (1968) found that all the entire-leaved species he studied have the basic chromosome number of n=6, and that although the cytological evidence separating the single-toothed species from the double-toothed species in not too convincing because of the same basic chromosome number of n=6 in both groups, they can still be cytologically separated on the basis of the presence of subterminal or terminal spindle-attachment regions in the double-toothed species and the absence of these in the single-toothed species. All the six species studied here belong to the double-toothed group and have the basic chromosome number of n=6. Thus, our results, though without

reference to the chromosome morphology, at least to some extent support Bower's generalization.

Mnium marginatum is the only synoicous one of the six species studied, and it has the chromosome number of n=12. In the genus *Mnium*, a diploid gametophyte number is usually correlated with the synoicous condition. Our result reinforces this point. As regards to its origin, Bowers (1968) considered that *M. marginatum* might be an autodiploid derived from *M. ambiguum*.

Our count of n=6 for *M. laevinerve* agrees with the previous report by Kumar (1973) but disagrees with the reports of n=7 by Tatuno *et al.* (1966) and Ono (1970). In the latter two authors' papers, there are clearly seven chromosomes in this species which consist of six long and one very short, or "m" chromosomes. In fact, almost all the species of *Mnium* studied by these two authors have the chromosome number of n=7. Both of them attached great importance to the observation of the "m" chromosome, which was rarely reported by other authors.

More extensive and intensive cytological studies, especially those with proper reference to gross morphological characters and sexual reproduction organism, should be carried out for a further understanding of the interspecific relationships within the genus *Mnium* in the Qinling Range.

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Explanation of Plate

Plate 1 1,3～10. Meiosis in sporocytes; 2. Mitosis in stem apices.

1. *M. pseudolycopodioides* C. Muell, n = 6, 1. MI; 2. *M. marginatum* (With) P. Beauv., n = 12; 3～4. *M. lycopodioides* Schwaegr., n=6, 3. MI, 4. AI; 5～6. *M. laevinerve* Card., n=6, 5. MI, 6. AI; 7～8. *M. heterophyllum* (Hook.) Schwaegr., n=6, 7. MI, 8. AI; 9～10. *M. thomsonii* Schimp., n =6, 9. MI, 10. AI.

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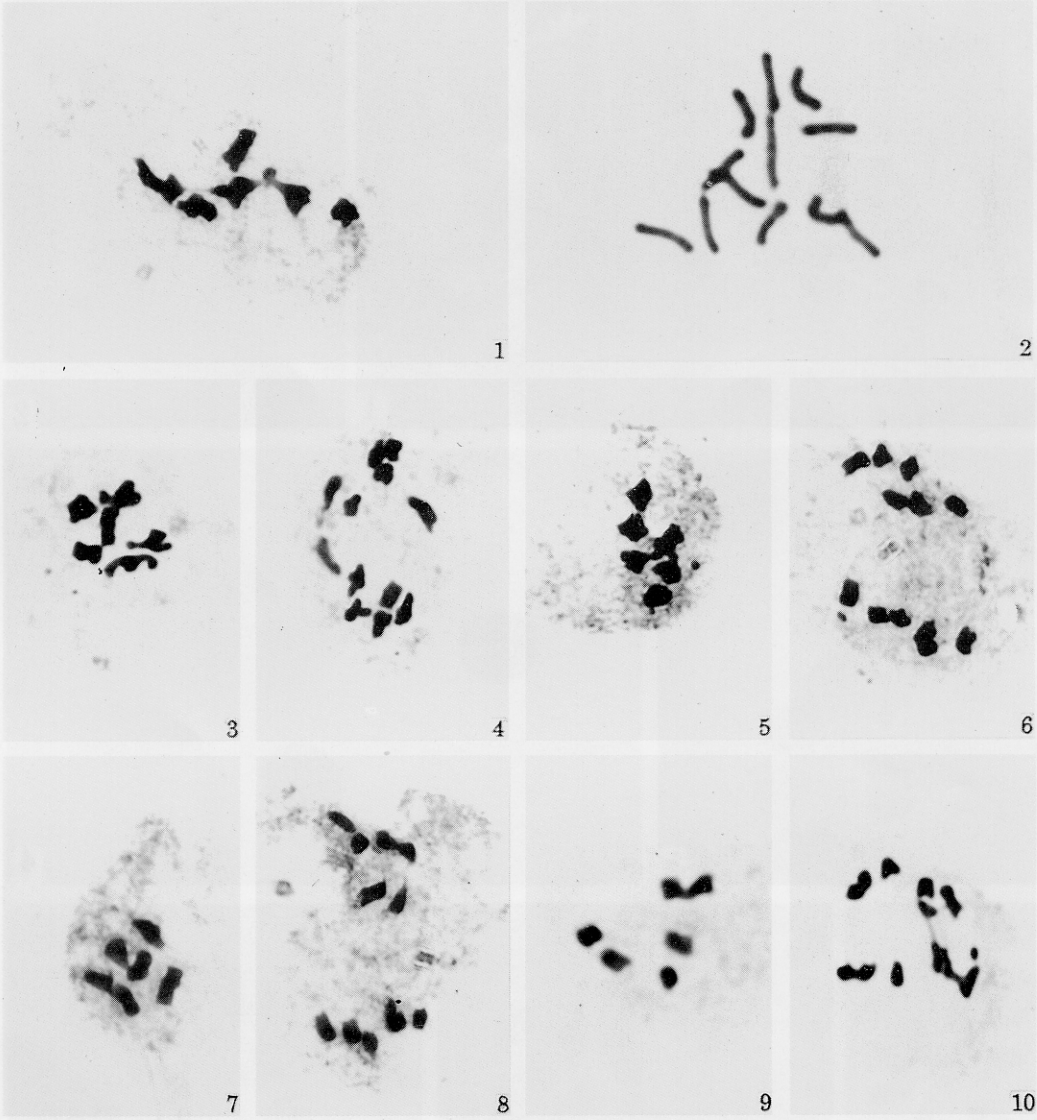

See explanation at the end of text